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TECHNICAL REPORT

	SATRA reference:	SPC0344316	
		2307	2
	Report ID/Issue number:	31961/4	
	Your reference:		
	Date samples received:	17/02/2023	
	Date(s) work carried out:	04/07/2023 to 09/08/2023	
	Date of report:	16/04/2024	

Testing Requirements

Testing of tape referenced as CSR-1303-2 in accordance with EN ISO 20471: 2013 + A1: 2016 clauses 6.1 and 6.2

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Report Signed by:

Daniel Harrison

Report Signatory

INTRODUCTION

Retro-reflective material, as described below, was submitted for testing to EN ISO 20471:2013+A1:2016, clauses 6.1 and 6.2, and as indicated below.

CONCLUSIONS

Sample Reference	EN ISO 20471:2013+A1:2016	Result
CSR-1303-2	Clause 6.1 Retro-reflective Performance of new materials	PASS Separate
	Clause 6.2 Retro-reflectivity after pre-treatments	PASS
	Clause 6.2 Retro-reflectivity in rainfall	PASS
	Clause 6.2 Retro-reflectivity after washing (EN ISO 6330:2021), 25 cycles, 60°C	PASS
	Clause 6.2 Retro-reflectivity after washing (EN ISO 6330:2021), 25 cycles, 40°C	PASS

PHOTOGRAPH

SATRA Report Reference: SPC0344316 2307
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TEST REQUIREMENTS

EN ISO 20471:2013+A1:2016 Minimum coefficient of retro-reflection in cd/(lx•/m²) for separate performance retroreflective material.

Observation angle	Entrance angle β_1 ($\beta_2 = 0$)							
	5°		20°		30°		40°	
	See Note 1	See Note 2	See Note 1	See Note 2	See Note 1	See Note 2	See Note 1	See Note 2
12’	330	*247.5*	290	*217.5*	180	*135*	65	*48.8*
20’	250	*187.5*	200	*150*	170	*127.5*	60	*45*
1°	25	*18.9*	15	*11.3*	12	*9*	10	*7.5*
1° 30’	10	*7.5*	7	*5.25*	5	*3.75*	4	*3*

EN ISO 20471:2013+A1:2016 Requirements for retroreflective performance after test exposure cd/(lx•/m²)

Exposure	Observation angle 12’, Entrance angle 5° See note 1		Observation angle 12’, Entrance angle 5° See note 2	
	Separate Performance	Combined Performance	Separate Performance	Combined Performance
Abrasion	100	30	*75*	*22.5*
Flexing	100	30	*75*	*22.5*
Folding at cold temperatures	100	30	*75*	*22.5*
Temperature variation	100	30	*75*	*22.5*
Rainfall	100	15	*75*	*11.25*
Washing	100	30	*75*	*22.5*
Dry cleaning	100	30	*75*	*22.5*

Separate performance retro-reflective material and combined performance material must also meet minimum specified requirements after being exposed to various pre-treatments and also under the influence of rainfall. After exposure a separate performance material, which is measured at the measurement condition of observation angle 12’ and entrance angle 5°, must achieve a minimum coefficient of retro-reflection value of 100cd/(lx·m²). A combined performance material, measured under the same conditions, must meet the minimum requirements of 30cd/(lx·m²), and under the influence of rainfall it must be 15cd/(lx·m²).

RESULTS

Material as received – *x* orientation

All measurements in cd/(lx·m²) Minimum requirements for separate perf. material shown in [square brackets]

Observation Angle, α	Entrance angle ß1 (ß2 = 0)								UoM (%)
	5°		20°		30°		40°		
12’	[330]	>480	[290]	>480	[180]	>480	[65]	>480	± 8.0 See note 3
20’	[250]	360	[200]	364	[170]	362	[60]	303	
1°	[25]	42.6	[15]	42.6	[12]	37.4	[10]	25.2	
1° 30’	[10]	20.2	[7]	20.7	[5]	19.7	[4]	19.3	

Material as received – y orientation

All measurements in cd/(lx·m²) Minimum requirements for separate perf. material shown in [square brackets]

Observation Angle, α	Entrance angle ß1 (ß2 = 0)								UoM (%)
	5°		20°		30°		40°		
12’	[330]	>480	[290]	>480	[180]	>480	[65]	>480	± 8.0 See note 3
20’	[250]	364	[200]	366	[170]	360	[60]	289	
1°	[25]	41.8	[15]	41.5	[12]	35.6	[10]	23.6	
1° 30’	[10]	20.3	[7]	20.7	[5]	19.8	[4]	20	

Sample direction	Observation Angle, α	Entrance angle, $ß_1$ ($ß_2$ = 0) 5°	UoM (%)	Sensitive/ Non-sensitive
x - direction	12’	>480	± 8.0	Materials having coefficients of retroreflection that differ by more than 15% are defined as orientation sensitive
y - direction	12’	>480		
Difference between x & y direction		N/A		Non-Sensitive
Difference expressed as a percentage (%)		N/A		

EN ISO 20471:2013 +A1:2016 Clause	Pre-Treatment	Observation angle 12', Entrance angle 5° x orientation *cd/(lx·m²)*	Observation angle 12', Entrance angle 5° y orientation *cd/(lx·m²)*	UoM %	PASS / FAIL
7.4.1	Abrasion	500	508	±8.0	PASS
7.4.2	Flexing	520	517		PASS
7.4.3	Folding at Cold Temperature	517	526		PASS
7.4.4	Exposure to Temperature Variation	491	490		PASS
7.4.5	Retroreflective Performance in Rainfall	154	---		PASS
7.5.2	Washing: 60°C: 25 cycles	288	287		PASS
*7.5.2	Washing: 40°C: 25 cycles	311	307		PASS

Domestic washing to EN ISO 6330:2021, (6N, 60°C), with normal heat tumble drying after each wash.
*Domestic washing to EN ISO 6330:2021, (4N, 40°C), with normal heat tumble drying after each wash.

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